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(71)出願人　000001993
株式会社島津製作所
京都府京都市中京区西ノ京桑原町1番地

(72)発明者　中川　利久
京都市中京区西ノ京桑原町1番地　株式会社島津製作所三條工場内

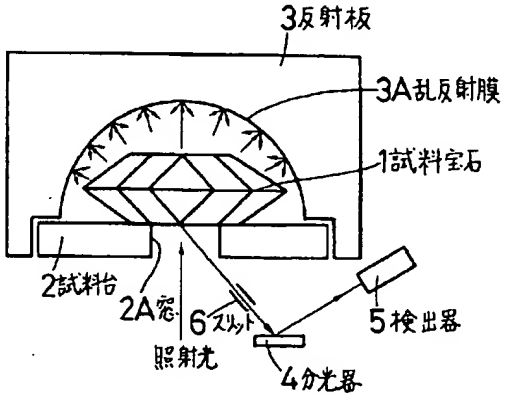
(74)代理人　弁理士　縣　浩介

(54)【発明の名称】　色彩測定装置

(57)【要約】

［目的］　本発明は、宝石等の透明，半透明試料の色彩測定において、検出器に入射する試料の色彩の情報を担った測定光の光量を増加させて、測定感度を向上させることを目的とする。

［構成］　本発明は、試料1を内面が白色である乱反射板3で覆い、試料透過光の全てを乱反射板3で反射させ、その反射光を再度試料に入射させることによって、試料内の内部散乱光のみでなく、試料透過光を再透過させて、検出器に入射する光量を増加させることにより、試料の厚さを2倍以上にしたのと同じ効果を得るようにした。



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【特許請求の範囲】

【請求項1】試料を分光反射特性が平坦な乱反射面を持つ反射板で囲み、試料に光を照射する手段と、上記照射光の試料表面における直接反射光或は直接透過光が入射しない位置で試料から放射される光を測光する測光手段を設けたことを特徴とする宝石色彩測定装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、宝石等の着色透明及び半透明体の透過光或は散乱光の波長特性を測定する色彩測定装置に関する。

【0002】

【従来の技術】宝石等の透明体の色は、白色光を入射させたときの透過光の色であり、半透過体の色も、内部散乱が大きいと云うだけで、色が見える理由は透明体と同じである。所が、従来の色彩測定装置は、図2に示すように、測定光として、試料宝石1から特定方向への放射される内部散乱光だけを用いているが、透明度が高い場合、照射光の殆どが透過光となり、その透過光は測定に寄与しないので、検出器5に入射する光量は少なく、従って、測定感度が低くくなると云う問題があった。

【0003】

【発明が解決しようとする課題】本発明は、検出器に入射する測定光の光量を増加させて、測定感度を向上させることを目的とする。

【0004】

【課題を解決するための手段】色彩測定装置において、試料を白色即ち分光反射特性が平坦な乱反射面を有する反射板で囲み、直接透過光や直接反射光が入射しない位置で試料から放射される光を測光するようにした。

【0005】

【作用】従来装置では、試料に入射させた光のうち直接散乱光のみを測定していたが、本発明の場合、検出器で測定している光は、入射光が宝石内で内部散乱された光だけでなく、宝石の周囲を乱反射板で完全に覆い、透過光の全てを乱反射板で反射させ、その反射光を再度宝石に投射させ、その透過光をも測定するので、その光は宝石内を少なくとも2回通って吸収を受けているから、単に検出器に入射する光量が増しているのでなく、試料による吸収を受けた光の量が増加するから色彩測定の感度が向上する。

【0006】

【実施例】図1に本発明の一実施例を示す。1は試料宝石、2は試料宝石1をセットする試料台で、中央に窓2Aを設けてあり、同窓2Aから試料宝石1に光を照射すると共に、上記照射光の試料面での正反射光が入射しない方向で、試料から来る光を取出し、分光器4で分光した後、検出器5で光量を検出する。3は反射板で、内側を半球状の凹面とし、その内表面を硫酸バリウム等の白色乱反射層で覆い乱反射膜を構成してある。6はスリットで、分光器4に入射する光の方向を規制する。

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【0007】試料宝石1に窓2Aから光を照射すると、その一部は試料内で散乱され、更にその一部が分光器に直接入射する。試料宝石1を直接或は内部散乱されて透過した光は、反射板3で乱反射され、色々な角度から試料宝石1に再投射される。再投射された光の一部は、試料背面で反射されるが、再び、反射板3で乱反射され、色々な角度から試料宝石1に再投射される。即ち、試料の背後に出射した光は、全て反射板3で乱反射されて試料宝石1に再投射されるので、宝石内で内部散乱される光は一段と増加し、窓2Aから放射される内部散乱光は増加する。窓2Aから出射した光は、試料内の散乱光と乱反射板からの反射光のうちの直進透過光で何れも試料の分光吸収特性による吸収を受けており、試料の色を表す光となっており、この光からスリット6で特定方向の光だけを取り出し、分光器4で波長走査しながら、検出器5で光強度を測定し、波長スペクトルを入手し、試料の分光吸収率を求める。

【0008】上記実施例では、図1で試料台2の上面をなんら規定していないが、乱反射膜で構成した方がより効果が期待できる。また、検出器を、入射光側でなく、背後で直接透過光が入射しない場所に設置してもよい。

【0009】

【発明の効果】本発明によれば、試料透過光を乱反射させて、再度、試料に照射するようにしたことで、試料の厚さを2倍にした以上に入射光の試料による吸収，散乱の効果が高められ、色彩測定感度を一段と向上させることができた。

【図面の簡単な説明】

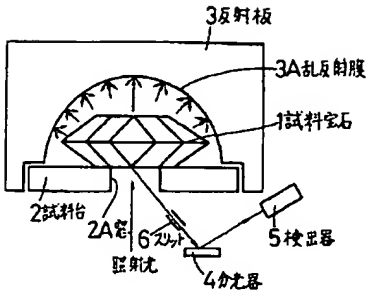
【図1】本発明の一実施例の側断面図

【図2】従来例の側断面図

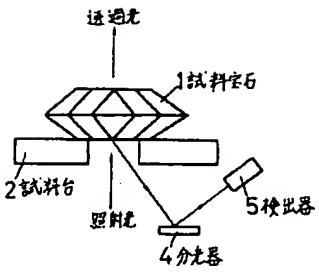
【符号の説明】

1　試料宝石
2　試料台
2A　窓
3　反射板
3A　乱反射膜
4　分光器
5　検出器
6　スリット

【図1】


3反射板
3A乱反射膜
1試料室
2試料台
2A窓
6スリット
照射光
5検出器
4分光器

【図2】


透過光
1試料室
2試料台
照射光
5検出器
4分光器

TRANSLATION FROM JAPANESE

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(71) Applicant: 000001993
Shimadzu Corp.
1, Nishinokyo Kuwabara-cho
Nakagyo-ku, Kyoto

(72) Inventor: Toshihisa Nakagawa, employee of
Sanjo Plant
Shimadzu Corp.
1, Nishinokyo Kuwabara-cho
Nakagyo-ku, Kyoto

(74) Agent: Kosuke Agata, patent attorney

(54) <Title of the Invention>

Color Measuring Apparatus

(57) <Summary>

<Object> The present invention has as its object, in the color measurement of a transparent or semitransparent test piece such as a gemstone, to increase the amount of measuring light that is incident into the detection device and which bears the color information of the test piece and improve the measuring sensitivity.

<Structure> In the present invention, the test piece 1 is covered by the diffusion reflection plate 3 the inner surface of which is white, all of the light that passes through the test piece is reflected by the diffusion reflection plate 3, due to the fact that the reflected light is incident again into the test piece, not only the light that is scattered internally within the test piece but the light that passes through the test piece is made to pass through again and the advantageous result can be obtained that, because of the increase in the amount of light that is incident into the detection device, it is the same as if the thickness of the test piece had been doubled or more.

1 test piece gemstone
2 test piece platform
2A window
3 reflecting plate
3A diffusion reflection film
4 spectrometer
5 detection device
6 slit
[below 6]
radiated light

<Claims>
<Claim 1> A color measuring apparatus characterized in that it has established a means in which a test piece is surrounded by a reflecting plate that has a diffusion reflection surface the spectrum reflection characteristics of which are flat and light is radiated into the test piece, and

a measuring means in which the light that is emitted from the test piece at a location where directly reflected light on the surface of the above mentioned light irradiated test piece or the light that directly passes through are not incident is measured.

<Detailed Description of the Invention>
<0001>
<Field of Industrial Utilization> The present invention relates to a color measuring apparatus with which the wavelength characteristics of light that passes through or light that is scattered by a colored transparent or semitransparent body is measured.

<0002>
<Prior Art> The color of a transparent body such as a gemstone is the color of the light that passes through when white light is incident on it and for the color of a semitransparent body also, the internal scattering can be said to be great but the reason that color is seen is the same as for a transparent body. However, with color measuring apparatuses of the past, as is shown in Fig. 2, only light that is scattered internally and emitted toward a specific direction from the test piece gemstone 1 is used as the measured light and, since nearly all of the radiated light passes through in the case where the transparency is high, the amount of light that is incident into the detection device 5 is small and, accordingly, there has been a problem in that the measurement sensitivity is low.

<0003>
<Problems of Prior Art To Be Addressed by the Invention> The present invention has as its object to increase the amount of measuring light that is incident into the detection device and improve the measuring sensitivity.

<0004>
<Measures to Solve the Problems of Prior Art> It is set up so that in a color measurement apparatus, the test piece is surrounded by a reflecting plate that is white, in other words, has a diffusion reflection surface the spectrum reflection characteristics of which are flat, and the light that is emitted from the test piece at a location where the light that directly passes through or the directly reflected light are not incident is measured.

<0005>
<Action> In the apparatuses of the past, only the light that is directly scattered from the light that is incident on the test piece is measured. However, in the case of the present invention, the light that is measured by the detecting device is not only the light which is incident light that is scattered internally within the gemstone. Since the periphery of the gemstone is completely covered with a diffusion reflection plate, all of the light that passes through is reflected by the diffusion reflection plate and that light that passes through is also measured, the light passing

through and absorbed in the gemstone at least twice. Therefore, since the amount of light that is incident into the detection device is not simply increased but the amount of light that has been absorbed by the test piece is increased, the sensitivity of the color measurement is improved.

<0006>
<Preferred Embodiments> Fig. 1 shows one preferred embodiment of the present invention. 1 is the test piece gemstone, 2 is the test piece platform upon which the test piece gemstone 1 is set and there is a window 2A established in its center. Together with the radiation of light into the test piece gemstone 1 through this window 2A, light that comes from the test piece that is not in the direction in which the light that directly is reflected from the surface of the above mentioned radiated light is incident is taken out and after separation into spectra by the spectrometer 4, the amount of light is detected by the detection device 5. 3 is the reflecting plate the inside of which is the concave surface of a hemisphere and the inner surface is covered with a white diffusion reflection layer of barium sulfate and the like forming a diffusion reflection film. 6 is a slit with which the direction of the light that is incident on the spectrometer 4 is controlled.

<0007> When the test piece gemstone 1 is irradiated with light from the window 2A, a portion of it is scattered in the test piece and, in addition, a portion is directly incident on the spectrometer. The light that directly passes through or is scattered inside and passes through the test piece gemstone 1 is diffused and reflected by the diffusion reflection plate 3 and is projected again at the test piece gemstone 1 from various angles. A portion of the reprojected light is reflected by the back surface of the test piece, however, it is again diffused and reflected by the reflecting plate 3 and again projected into the test piece gemstone 1 from various angles. In other words, since the light that is emitted from the back of the test piece is all diffused and reflected by the reflection plate 3 and projected again into the test piece gemstone 1, the light that is scattered inside within the gemstone is further increased and the internal scattered light that is emitted from the window 2A is increased. With regard to the light that is emitted from the window 2A, the scattered light inside the test piece and the light that passes through in a straight line from among the reflected light from the diffusion reflection plate are both absorbed due to the spectrum absorption characteristics of the test piece and become light that exhibits the color of the test piece. From this light, only the light that is in the specific direction of the slit 6 is extracted. While wavelength scanning is done by the spectrometer 4, the strength of the light is measured by the detection device 5, the wavelength spectrum is obtained and the spectrum absorption rate of the test piece is derived.

<0008> In the above mentioned preferred embodiment, the upper surface of the test piece platform 2 in Fig. 1 is not restricted in any way but it can be expected to be more effective if it is configured by the diffusion reflection film. In addition, the detection device may be established not on the incident light side but in a place on the back where the light that passes directly through is not incident.

<0009>
<Advantageous Result of the Invention> By means of the present invention, the light that passes through the test piece is diffused and reflected and, due to the fact that it is radiated into the test piece once again, the reflected light is absorbed by the test piece as if the thickness of the test

piece had been doubled or more, the effect of the scattering is raised and it is possible to further improve the color measurement sensitivity.

<Brief Description of the Drawings>
Fig. 1 is a lateral cross-section drawing of one preferred embodiment of the present invention, and

Fig. 2 is a lateral cross-section drawing of an example of the past.

<Description of the Keys>
1 test piece gemstone
2 test piece platform
2A window
3 reflecting plate
3A diffusion reflection film
4 spectrometer
5 detection device
6 slit

Fig. 1
1 test piece gemstone
2 test piece platform
2A window
3 reflecting plate
3A diffusion reflection film
4 spectrometer
5 detection device
6 slit
[below 6]
radiated light

Fig. 2
1 test piece gemstone
2 test piece platform
4 spectrometer
5 detection device
[above gemstone]
light that passes through
[below platform]
radiated light